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(54) **PORTABLE ELECTRONIC DEVICE WITH CONDUCTING POLE**

(75) Inventors: **Kuan-Chang Lin**, Tu-Cheng (TW);
Ting-Chang Chang, Tu-Cheng (TW)

(73) Assignee: **Chi Mei Communication Systems, Inc.**, Tu-Cheng, Taipei County (TW)

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See application file for complete search history.

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Primary Examiner—Dameon E Levi

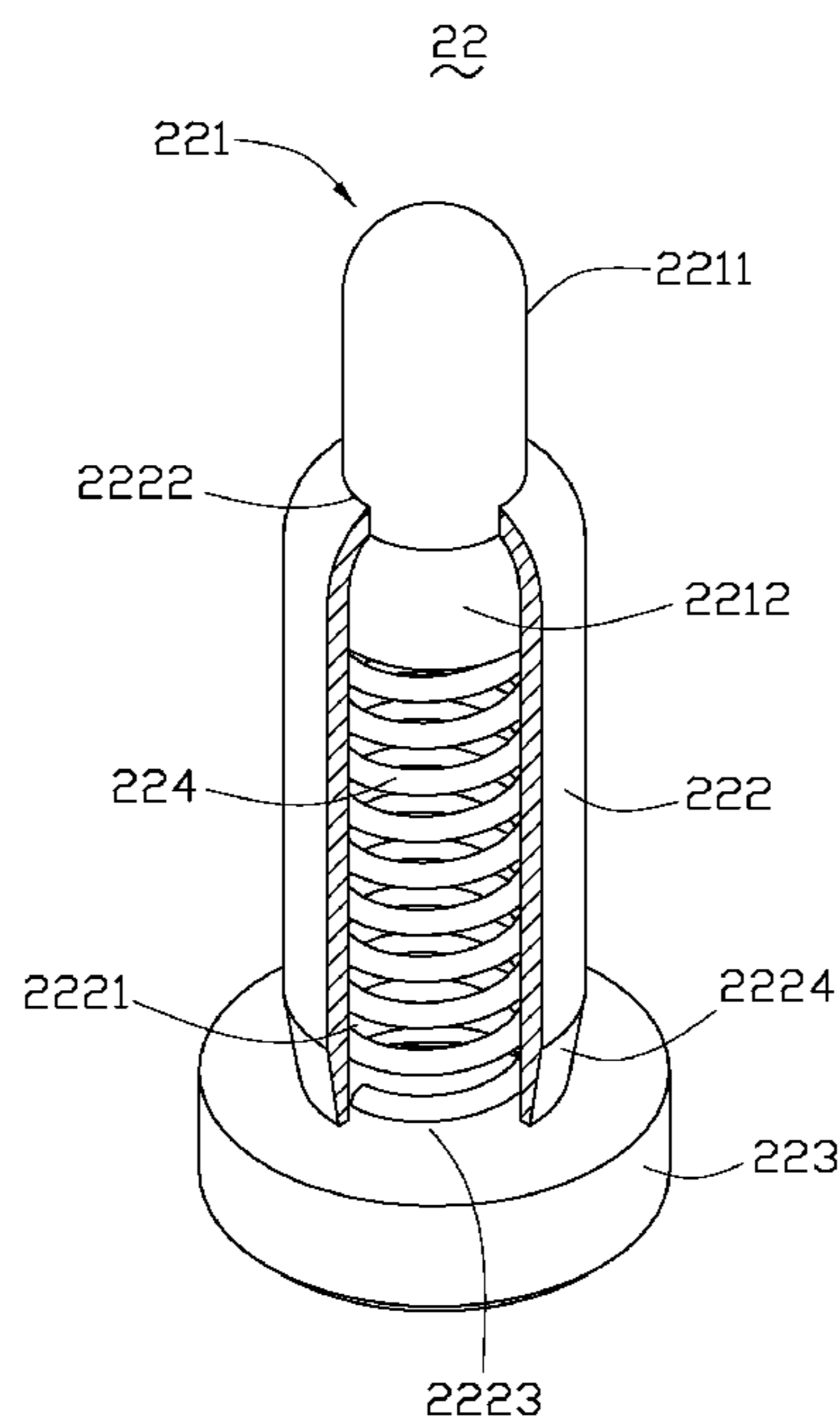
Assistant Examiner—Hoa C Nguyen

(74) *Attorney, Agent, or Firm*—Jeffrey T. Knapp

(57) **ABSTRACT**

A portable electronic device (20) includes a circuit board (21) and at least one conducting pole (22). The conducting pole is mounted on the circuit board and includes a breakable portion (2224), the breakable portion is configured to be the part that breaks when the conducting pole is crumpled.

14 Claims, 4 Drawing Sheets



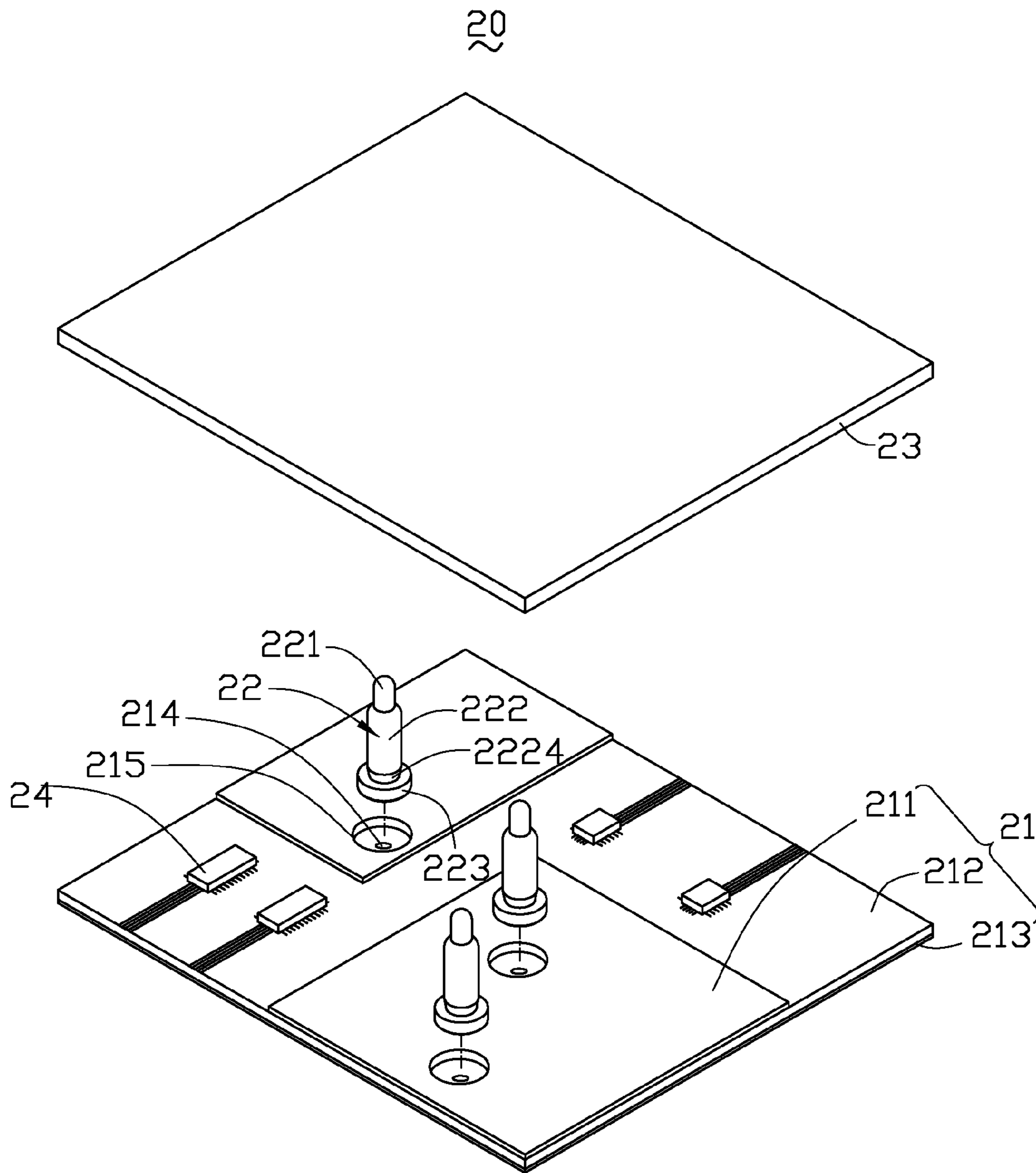


FIG. 1

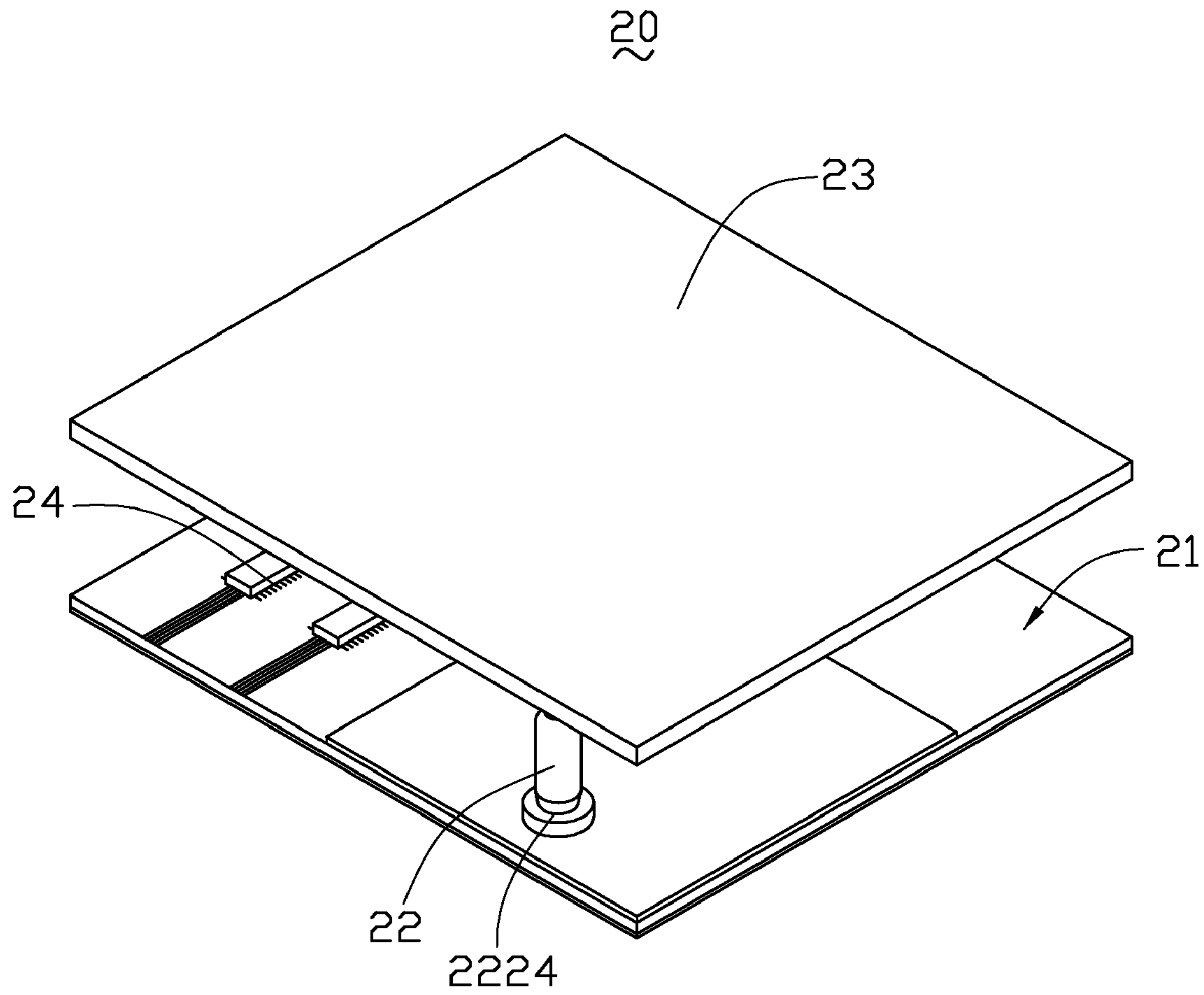


FIG. 2

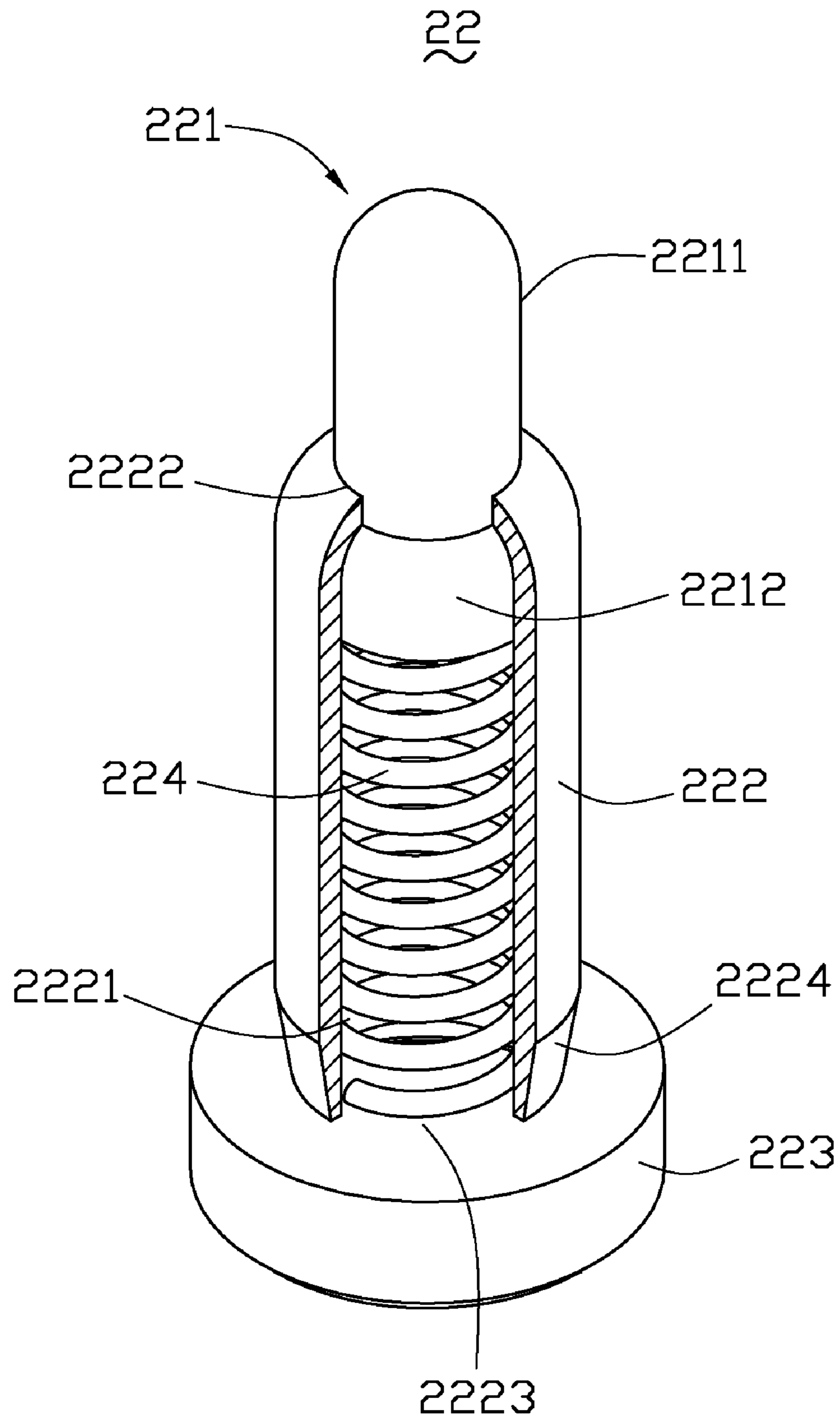


FIG. 3

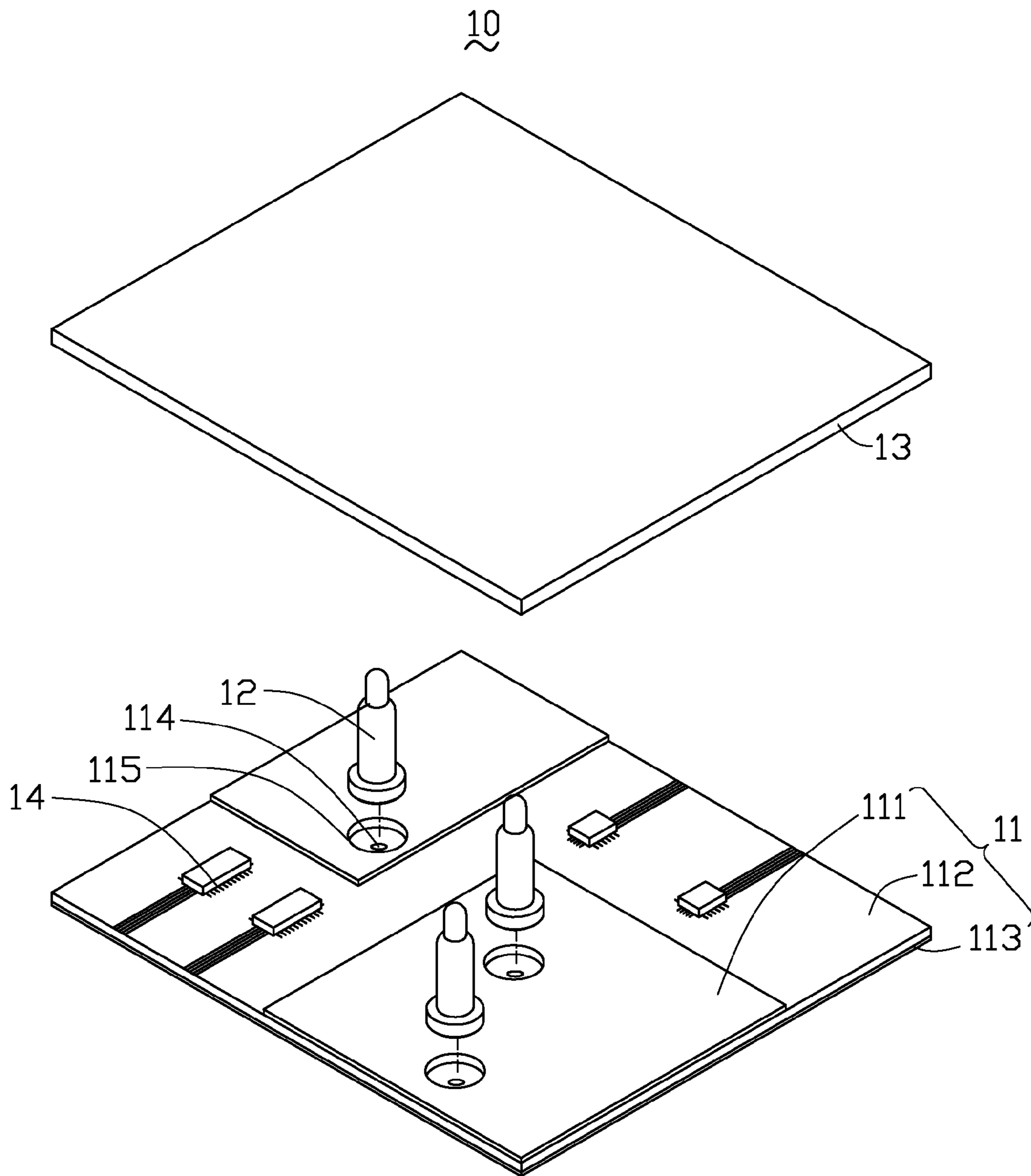


FIG. 4
(RELATED ART)

1**PORTABLE ELECTRONIC DEVICE WITH
CONDUCTING POLE**

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to portable electronic devices, and, particularly, to a portable electronic device with at least one conducting pole.

2. Description of Related Art

Nowadays, portable electronic devices, such as mobile phones, laptops and personal digital assistants (PDAs) are widely used. Generally, a circuit board is a main component within a portable electronic device. When the portable electronic device is in use, it is prone to cause electrostatic charges, thus damages the circuit board within. Therefore, most portable electronic devices have grounding apparatuses configured to prevent the electrostatic charges from damaging the circuit boards.

Referring to FIG. 4, a typical portable electronic device **10** includes a circuit board **11**, a plurality of conducting poles **12**, a cover board **13** and a plurality of circuit components **14**. The cover board **13** is configured to be a part of a housing of the portable electronic device **10** and protects the circuit board **11**. The conducting poles **12** are electronically connected to the circuit board **11** and stably support the cover board **13** in a proper position. The circuit components **14** are mounted on the circuit board **11**.

The circuit board **11** includes a conducting layer **111**, an insulated layer **112**, a grounding layer **113** and a plurality of conducting members **114**. The conducting layer **111** is configured to be patterns of circuit which cover a portion of the insulated layer **112**. The insulated layer **112** is formed between the conducting layer **111** and the grounding layer **113**. The circuit board **11** defines a plurality of conducting apertures **115** corresponding with the conducting members **114** and running through the insulated layer **112**. The conducting members **114** are conductive portions formed on the grounding layer **113** and electronically connected to the grounding layer **113**, each conducting member **114** exposes from its corresponding conducting aperture **115**. The conducting poles **12** are inserted into the conducting apertures **115** and thus are electronically connected to the conducting members **114**. In this way, the electrostatic charges of the cover board **13** can be transferred to the grounding layer **113** via the conducting poles **12** and the conducting members **114**.

However, after the conducting poles **12** are mounted in the conducting apertures **115**, the cover board **13** is assembled with the circuit board **11**. Since the conducting poles **12** are protruding from the conducting apertures **115**, the cover board **13** may crash the conducting poles **12** in assembly or in use. The crumpled conducting poles **12** may be distorted by the crash, and the insulated layer **112** and the conducting members **114** connected to the conducting poles **12** may also be distorted by the distorted inserting conducting poles **12**. Thus, the circuit board **11** may be badly damaged. Furthermore, it is difficult to repair the distorted portions in the conducting aperture **115** of the circuit board **11** and the distorted conducting members **114**, which slow down the assembly process.

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Therefore, an improved portable electronic device is desired in order to overcome the above-described shortcomings.

SUMMARY OF THE INVENTION

In one embodiment thereof, a portable electronic device includes a circuit board and at least one conducting pole. The conducting pole is mounted on the circuit board and includes a breakable portion, the breakable portion is configured to be the part that breaks when the conducting pole is crumpled.

Other novel features will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Many aspects of the portable electronic device can be better understood with reference to the following drawings. The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the present portable electronic device. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

FIG. 1 is an exploded view of a portable electronic device in accordance with a present embodiment;

FIG. 2 is an assembled view of the portable electronic device shown in FIG. 1;

FIG. 3 is a cut-away view of the conducting pole shown in FIG. 1; and

FIG. 4 is an exploded view of a typical portable electronic device with conducting poles.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1 and FIG. 2, a portable electronic device **20** according to a first embodiment of the present invention is provided. The portable electronic device **20** can be mobile phones, laptops, and personal digital assistants (PDAs), etc. The portable electronic device **20** includes a circuit board **21**, a plurality of conducting poles **22** mounting on the circuit board **21**, a cover board **23** supported by the conducting poles **22** and a plurality of circuit components **24** mounted on the circuit board **21**. The cover board **23** is configured to be a part of a housing of the portable electronic device **20** and protects the circuit board **21**. The conducting poles **22** are mounted to the circuit board **21** and support the cover board **23**. The circuit components **24** can be resistors, capacitors, or transistors, etc.

The circuit board **21** includes a conducting layer **211**, an insulated layer **212**, a grounding layer **213** and a plurality of conducting members **214**. The insulated layer **212** is formed between the conducting layer **211** and the grounding layer **213**. The circuit **21** defines a plurality of conducting apertures **215** corresponding to the conducting members **214** and running through the insulated layer **212**. The conducting members **214** are conductive portions partially formed on the grounding layer **213** and partially received in the conducting apertures **215**. The conducting members **214** are electronically connected to the grounding layer **213**, and each conducting member **214** has a portion exposes from its corresponding conducting aperture **215**. The conducting poles **22** are inserted into the conducting apertures **215** and electronically connected to the conducting members **214**.

The conducting layer **211** is formed by metal such as copper, silver, tin, etc. The conducting layer **211** is configured to

be patterns of circuit which cover a portion of the insulated layer 212. The circuit components 24 are mounted on the conducting layer 211.

The insulated layer 212 is formed by insulated materials, such as plastics or epoxy, etc. The insulated layer 212 is configured to cover the grounding layer 213 to prevent short circuit from occurring between the conducting layer 211 and the grounding layer 213.

The grounding layer 213 is also formed by metal such as copper, silver, tin, etc. The grounding layer 213 is configured for transmitting the electrostatic charges of the portable electronic device 20 to ground to protect the circuit board 21.

The conducting members 214 are formed by metal such as copper, silver, tin, etc. The conducting members 214 are configured to electronically connect the grounding layer 213 to the conducting poles 22.

Also referring to FIG. 3, the conducting poles 22 are formed by metal such as copper, silver, tin, etc. Each conducting pole 22 includes a head member 221, a containing member 222, a connecting member 223 and a resilient member 224. The head member 221 is movably mounted on one end of the containing member 222, and the connecting member 223 is connected to an end opposite to the end mounting the head member 221 of the containing member 222.

The head member 221 includes a supporting portion 2211 and a mounting portion 2212 connected to the supporting portion 2211. A diameter of the supporting portion 2211 is less than that of the mounting portion 2212.

The containing member 222 is a hollow cylinder. The containing member 222 defines a cylindrical containing cavity 2221 in its central portion, and respectively defines a first open end 2222 and a second open end 2223 corresponding to the containing cavity 2221 at both ends. An inner diameter of the first open end 2222 is approximately equal to the diameter of the supporting portion 2211. An outer diameter of the containing member 222 decreases from its middle portion to the end defining the second open end 2223, thus a conical breakable portion 2224 is formed adjacent to the second open end 2223. In this way, a thickness of the breakable portion 2224 is configured to be less than that of any other part of the containing member 222, and the containing member 222 has the least thickness at an end of the breakable portion 2224, i.e., the second open end 2223 of the containing member 222.

The connecting member 223 is shaped as a column having a diameter approximately equal to the inner diameter of the conducting apertures 215. The resilient member 224 is a columnar spring.

In assembly, the head member 221 is inserted into the containing cavity 2221 from the second open end 2223, and the supporting portion 2211 extends out from the first open end 2222. The resilient member 24 is inserted into the containing cavity 2221 from the second open end 2223, and the mounting portion 2212 blocks one end of the resilient member 224. The connecting member 223 is mounted to the end having the least thickness of the breakable portion 2224, i.e., the second open end 2223 of the containing member 222, and the connecting member 223 blocks another end of the resilient member 24. In this way, a conducting pole 22 is assembled.

Each conducting poles 22 is inserted into a conducting aperture 215. The connecting member 223 is partially contained in the conducting aperture 215 and electronically connected to the conducting member 214 contained in the conducting aperture 215.

The cover board 23 covers the circuit board 21. The conducting poles 22 are electronically connected to the cover board 23. The supporting portion 2211 of each conducting

pole 22 stably supports the cover board 23 in a proper position. In this way, the circuit board 21 and the cover board 23 are assembled together. In use, the electrostatic charges of the cover board 23 can be transferred to the grounding layer 213 via the conducting poles 22 and the conducting members 214.

Understandably, in assembly or in use, the cover board 23 may cause damages to the conducting poles 22. However, since a thickness of the breakable portion 2224 is less than that of any other part of the conducting pole 22, when a conducting pole 22 is impacted, the breakable portion 2224 is likely to be the part that breaks first, thus the containing member 222 breaks away from the connecting member 223 to prevent circuit board 21 from being damaged by the conducting poles 22. The broken conducting poles 22 can be easily mounted to the circuit board 21 again via sealing or gluing.

It is believed that the present embodiments and their advantages will be understood from the foregoing description, and it will be apparent that various changes may be made thereto without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the examples hereinbefore described merely being preferred or exemplary embodiments of the invention.

What is claimed is:

1. A portable electronic device, comprising:

a circuit board; and

at least one conducting pole mounted on the circuit board, the conducting pole including a hollow containing member that includes two opposite open ends and a breakable portion formed adjacent to one of the two open ends, wherein a thickness of the breakable portion is decreased, such that the breakable is broken first due to its decreased thickness when the conducting pole is impacted.

2. The portable electronic device as claimed in claim 1, wherein, the containing member is a hollow cylinder, an outer diameter of the containing member decreasing from its middle portion to one end thereof to form the breakable portion.

3. The portable electronic device as claimed in claim 2, wherein a thickness of the breakable portion is less than that of any other part of the containing member.

4. The portable electronic device as claimed in claim 3, wherein the conducting pole includes a connecting member connected to the breakable portion.

5. The portable electronic device as claimed in claim 4, wherein the conducting pole includes a head member and a resilient member, the containing member defining a containing cavity therein, the resilient member being contained in the containing cavity, one end of the resilient member being blocked by the head member and another end of the resilient member being blocked by the connecting member.

6. The portable electronic device as claimed in claim 4, wherein the circuit board includes a conducting layer, an insulated layer and a grounding layer, the insulated layer being formed between the conducting layer and the grounding layer.

7. The portable electronic device as claimed in claim 6, wherein the circuit board defines at least one conducting aperture running through the insulated layer therein, and the connecting member is partially contained in the conducting aperture.

8. The portable electronic device as claimed in claim 7, wherein the circuit board includes at least one conducting member contained in the conducting aperture and electronically connected to the grounding layer.

9. The portable electronic device as claimed in claim 8, wherein the portable electronic device includes a cover board

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configured to be a part of the housing of the portable electronic device, supported by the head member and electronically connected to the conducting pole.

10. A conducting pole, comprising:

a hollow containing member, the containing member 5 including two opposite open ends and a breakable portion formed adjacent to one of the two open ends, wherein a thickness of the breakable portion is decreased to be less than that of any other parts of the containing member, such that the breakable portion is 10 broken first due to its decreased thickness when the conducting pole is impacted; and

a connecting member, the connecting member being connected to an end of the containing member for electronic connection.

11. The conducting pole as claimed in claim 10, wherein the connecting member is connected to the breakable portion.

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12. The conducting pole as claimed in claim 11, wherein an outer diameter of the containing member decreases from its middle portion to an end to form the breakable portion.

13. The conducting pole as claimed in claim 11, wherein the connecting member is connected to an end of the breakable portion that has a thickness less than that any other part of the containing member.

14. The conducting pole as claimed in claim 10, wherein the conducting pole includes a head member and a resilient member, the containing member defining a containing cavity therein, the resilient member being contained in the containing cavity, one end of the resilient member being blocked by the head member and another end of the resilient member 15 being blocked by the connecting member.

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